



MODDING THE KLH-17 INTO THE KLH-17 Plus

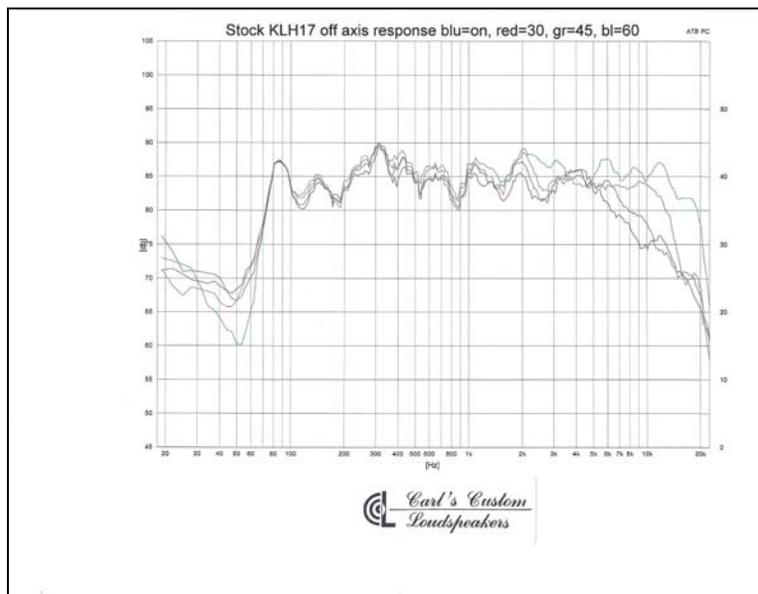
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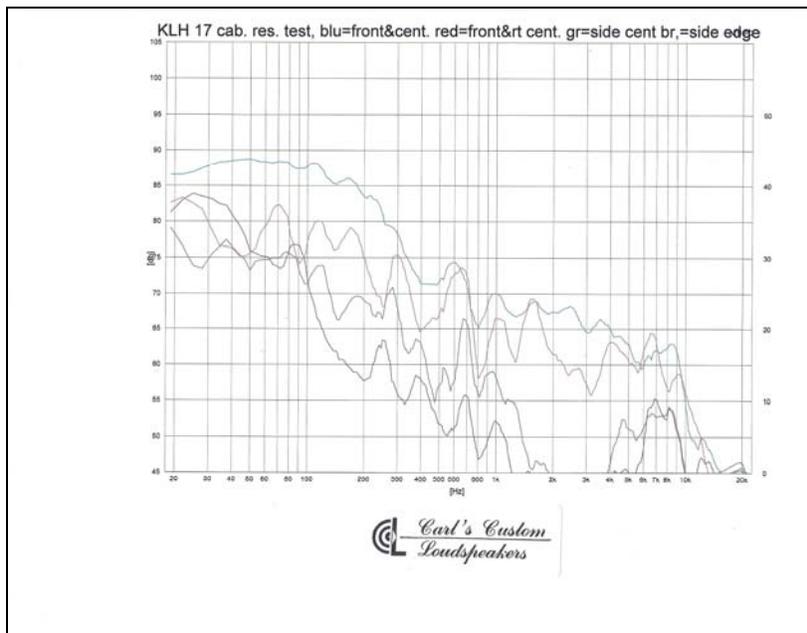
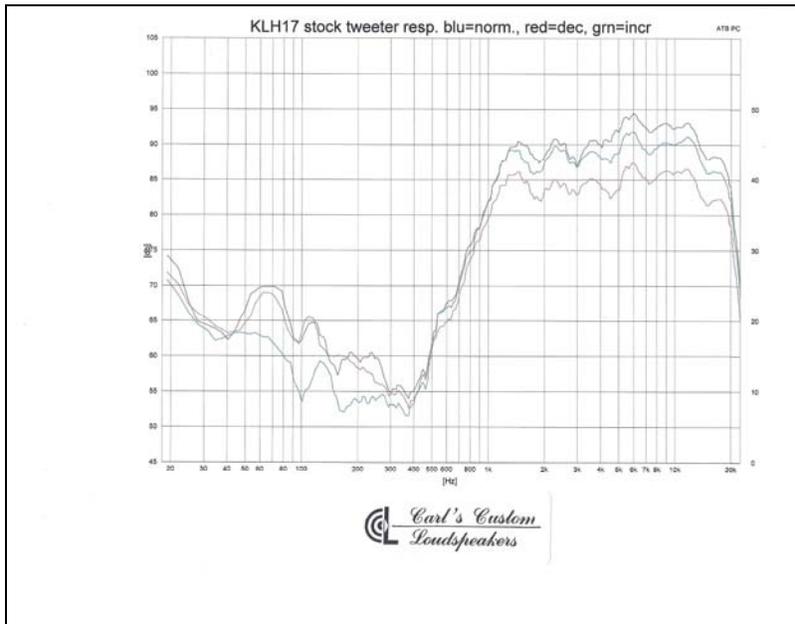
This document describes how I modded the classic KLH-17 into a formidable 2-way monitor loudspeaker. The work was done for a customer who requested an upgrade of medium cost with outstanding performance. The KLH-17 Plus exhibits excellent horizontal dispersion, clarity and a non-fatiguing listening experience. Optimum performance is obtained with the speakers sitting on stands with no toe-in and close to a wall for improved bass response.

Three designs were initially proposed. The first was an Econo-wave mod as described by Zilch at www.audiokarma.org. The second design incorporated a Heil AMT tweeter sitting atop the cabinet and utilizing the original woofer. The third, which was eventually adopted, incorporated a Fountek Neo CD2.0 ribbon tweeter and HiVi F8 woofer in a vented alignment.

INITIAL TESTING OF STOCK MODEL 17

Response and cabinet resonance tests were run. Some of the results appear below and on the next page. Note that these and all succeeding response tests are displayed with 1/6 octave smoothing on both ATB PC Pro and HOLMImpulse software.





The baffle board right center test just above the woofer showed significant resonance spikes at 300 and 650 hz. With this information it became apparent some bracing of the BB would be required.

The Fountek and HiVi drivers were purchased for testing and xover development utilizing a simple mock up incorporating a baffle board of the same dimensions as the KLH-17.



MOCK UP, ASSEMBLY AND OBJECTIVE TESTING

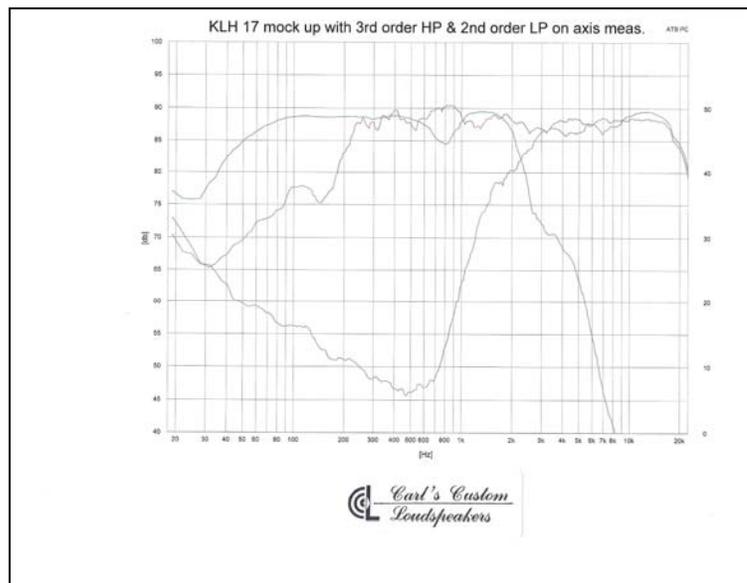
Below are pics of the mock up. Three orientations of the Fountek tweeter were tested. Vertical with 1 inch off center, 45 deg tilt and horizontal. It quickly became clear from response testing that the vertical orientation of the ribbon yielded the most desirable response for general listening configurations.



FRONT SIDE



BACK SIDE



On axis response tests of the final configuration and xover topology

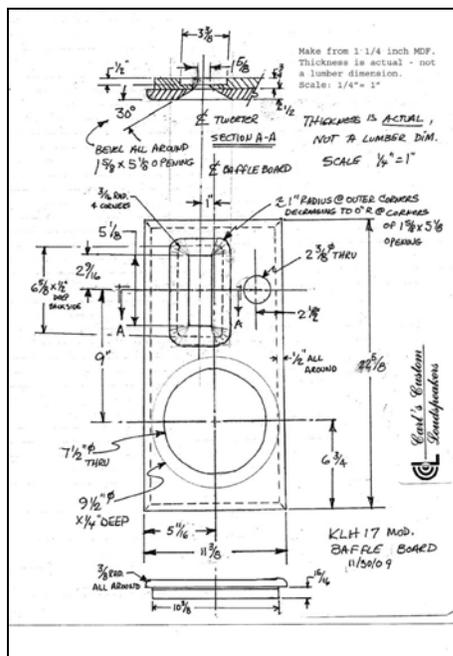


After considerable discussion with my customer, we agreed that some effort should be made to time align the drivers and also address the diffraction issues inherent with this type of classic cabinet having sharp edges and a recessed baffle board (BB).

What came to mind was the idea of a new BB mounted over the original and having rounded edges and a recessed pocket on the back side for mounting the Fountek tweeter set back from the woofer's focal plane. It was also felt that it would be highly desirable for the BB to include a machined flare to continue the 30 deg. bevel that exists on the face of the tweeter plate and somewhat similar to that used on Sonist loudspeakers (see below). <http://www.sonist.com/>



Below is the drawing I developed which was eventually used to fabricate two BB's. One as shown and a mirror imaged version (at customer's request).





A $1\frac{1}{4}$ inch wide by 10 inch long (1" pine) stiffening rib was installed in the inside of the cabinet just above the woofer hole (see pic below).

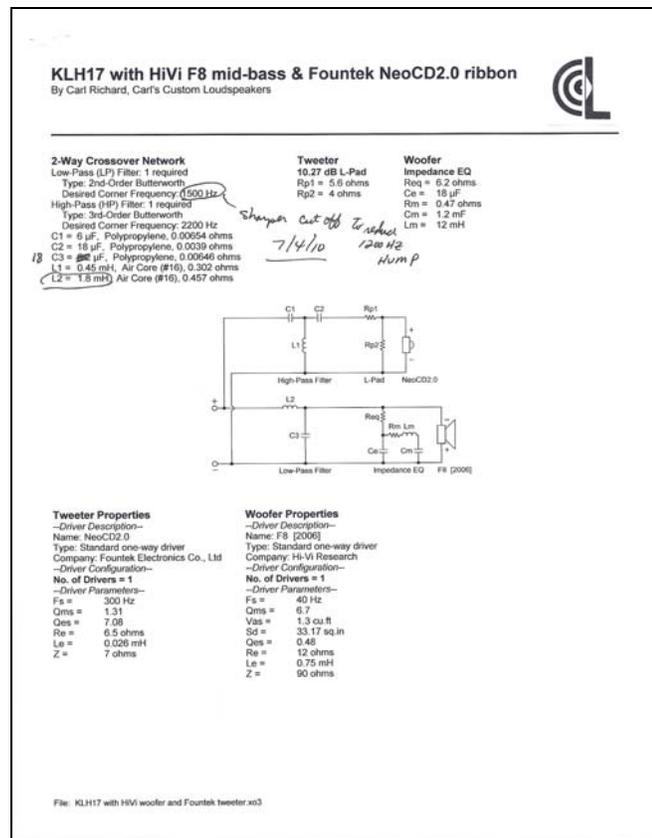


After 7 months of searching and two failed attempts, I found a carpenter who succeeded in accomplishing the difficult flared cut in a piece of $1\frac{1}{4}$ inch thick MDF. Below is a picture of the raw BB leaning against a 17 cabinet I modded a bit to clear the vent tube and the body of the Fountek tweeter.





BassBox and Xover Pro software was used to size the vent and design the crossover. The Fountek literature showed a freq. range of 1,200-40,000 Hz. and 97 dB eff. The HiVi literature showed an anomalous hump in the 4,000-5,000 Hz. range. After considerable testing with the mock up, I decided on a 2nd order Butterworth LP with a 1500 Hz crossover target to avoid the hump and a 2200 Hz. 3rd order Butterworth HP target for protection of the tweeter. The crossover was constructed and final componet values were arrived at after considerable tweaking. Fortunately, no special tank or trap circuits were needed to obtain the response shown on pg. 3. It was also noted that the HiVi woofer had a strange response dip around 800 hz. It is also visible in their literature. However, I felt it wasn't severe enough in width and depth to undertake a special circuit to help boost it to a flatter resp. It was also evident that a pot circuit would be needed to balance the tweeter's high efficiency with that of the much lower woofer (88-89 dB). Additionally, the customer was planning to locate these speakers in a variety of locations in his home and the increased flexibility of tuning the tweeter's output would be of considerable value vs a fixed two-resistor L-pad in series. Note that the schematic below does not show the 8 ohm 50W pot I used in a convention app. It shows Lpads which I also did not use.





With the new BB's in hand, I painted them black and assembled the speakers for final testing and listening evaluations. Convoluted acoustic foam was installed internally on the sides, back and base.

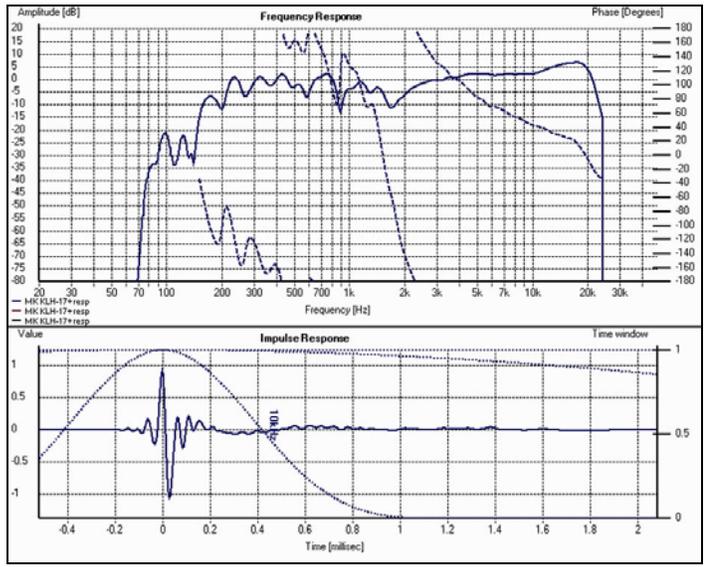


The 4 $\frac{3}{4}$ inch long plastic vents were painted yellow to compliment the color of the HiVi cones. Seven screws were used to fasten the new BB's to the face of the cabinets. The figure below shows a follow up cabinet resonance test which exhibits much improved performance devoid of resonant humps.

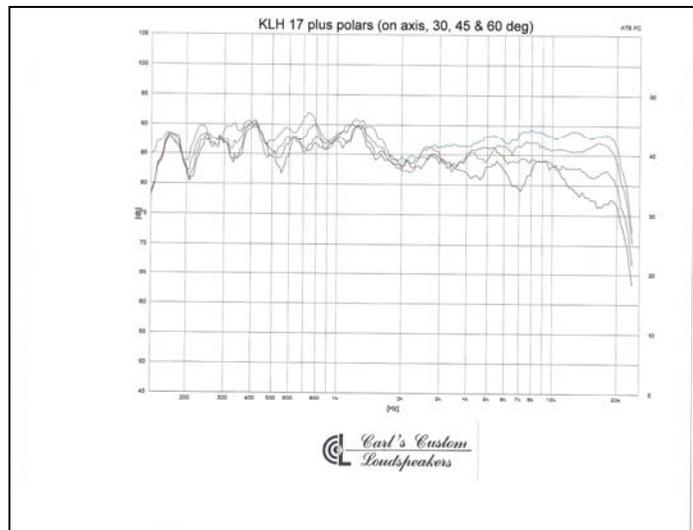


The 3 lines represent the front right center just above the woofer and cabinet sides.

The results of additional testing of the finished speakers are on the next page. In conducting the response tests with both ATB-Pro and HOLMImpulse software, I noticed an inconsistency in the tweeter 10-20 kHz range between the two software packages. The HOLMImpulse software showed a 5-7 dB rise in response in this range. Whereas, the ATB-Pro software did not. I suspect the difference was in the mic calibrations used for each. Which is correct? I don't honestly know.



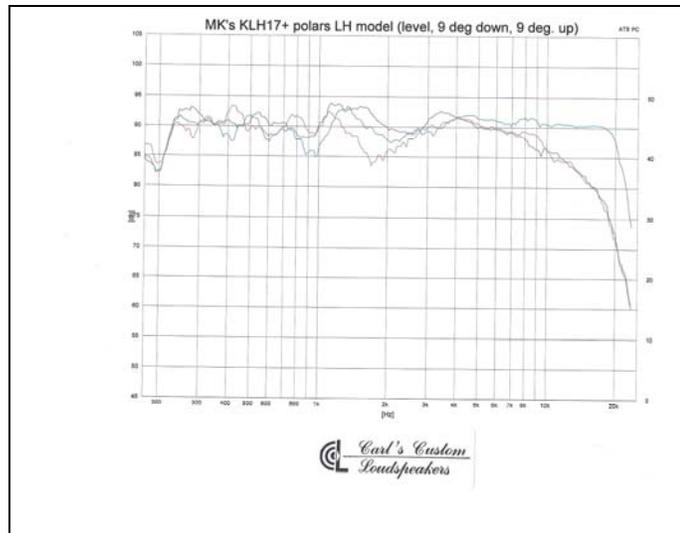
HOLMImpulse response and impulse test results (on axis).



Both the above ATB-Pro and HOLMImpulse responses show a very smooth response from the Fountek and a somewhat choppy response from the HiVi woofer. Horizontal off-axis performance was very good out to 60 deg. with essentially no change at 30 deg and a slight drop of 5-6 dB at 45 deg and a drop of only 20 dB at 60 deg. off axis.



Below is the result of a quick vertical polar test. Since I don't have a means to easily do vertical polars, I simply raised and lowered my test mic (ECM 8000) on its tripod as much as I could at 1 meter distance. The test revealed the ribbon tweeter's expected sharp fall off of 15 dB at only approx. 9 deg. off axis.



^Vertical polar response ^



KLH-17 Plus' rear panel.

Here we see the original speaker plate and new gold plated binding posts and potentiometer stem. Rubber grommets were salvaged from the stock speaker to ensure insulation of the binding posts away from the tin speaker plate. The new binding posts are also short enough to be below the back surface of the cabinet - a desirable feature.



SUBJECTIVE LISTENING TESTS

The speakers were set 5 feet apart atop a pair of AR3a's which put the tweeters at my ear level when sitting on a chair between them about 5 feet away. After some experimentation with toe in, I found the best imaging and response characteristics came from having them pointing straight ahead. The image was perfectly centered with a wide soundstage and a sparkling clarity which astounded me. I had not heard this kind of clarity from numerous speakers I've worked on over a number of years having more convention dome type tweeters. Many of my favorite test cuts were played; most of which incorporated acoustic instruments and vocals. Bass extension was lacking a bit due to its inherent low end limitation of 70 Hz at -6 dB. This could drop a few Hz more with extended playing time and break in. However, for jazz and small group classical ensembles, the 17 Plus shines. The HiVi woofer's bass extension and shaky response are a bit of a concern. If I had to do it all over again I'd certainly consider alternatives.

In reading the Sonist Concerto 3 review in Stereophile,
http://www.stereophile.com/floorloudspeakers/sonist_concerto_3_loudspeaker/index.html

I found a number of similarities between the 17 Plus and the Sonist speaker with the exception of the cabinet resonance noticed by Art Dudley and measured by John Atkinson and subsequently remediated by Sonist in a follow up to the review.

The 17 Plus is not a full range speaker, nor is it an 'in your face' rock speaker. As a monitor speaker I highly recommend DIY'rs give this mod a try.

KLH-17 Plus tentative specification

Frequency response.....	70 - 40 kHz \pm 6 dB
Impedance.....	8 ohm nom. 7.5 ohm min @ 175 & 3500 Hz.
Sensitivity.....	89 dB/W/M @2.83 V
Weight.....	35 lbs 6 oz. ea vs 24 lbs for orig.
Power handling.....	60 wpc nom. 100 wpc max.